

**FRENCH RIVER BASIN
DUDLEY, MASSACHUSETTS**

**PETER POND DAM
MA 00112**

PHASE I INSPECTION REPORT NATIONAL DAM INSPECTION PROGRAM



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**DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154**

AUGUST, 1978

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ABSTRACT (Continue on reverse side if necessary and identify by block number) The dam at Peter Pond is an earthfill dam with a downstream masonry wall. The dam has a maximum height of 10 feet and is approximately 225 feet long. It is classified in the "significant" hazard category. The dam is considered to be in good to fair condition. Based on size and hazard classification, the test flood falls between the 100 year storm and 1/2 the PMF.			

PETER POND DAM

MA 00112

FRENCH RIVER BASIN
DUDLEY, MASSACHUSETTS

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION
PROGRAM

NATIONAL DAM INSPECTION
PROGRAM

PHASE I INSPECTION REPORT

BRIEF ASSESSMENT

Identification No.: MA00112

Name of Dam: Peter Pond

Town: Dudley

County and State: Worcester County, Massachusetts

Stream: Tributary of French River

Date of Inspection: June 26, 1978

The dam at Peter Pond is an earthfill dam with a downstream masonry wall which was constructed some time prior to 1925. The dam has a maximum height of 10 feet and is approximately 225 feet long. There is no spillway for the dam. Discharge from the pond is through a stone box conduit 1 foot high by 1.9 feet wide. The approach to the conduit is a channel formed by two diverging concrete walls. Flashboards are located about 6 feet in front of the inlet to the conduit. The flashboards are about 3.6 feet wide and act as a weir, regulating the pond level. This is the only existing outlet at the site. There are no plans, specifications, or computations available from the Owner, County, or State offices regarding the design, construction or repairs of this dam.

Due to its age, Peter Pond Dam was neither designed nor constructed by current approved state-of-the-art methods. Based upon the visual inspection at the site, the dam is considered to be in good to fair condition. Peter Pond Dam has been classified in the "significant" hazard category. There are areas of concern which must be corrected to assure the continued performance of this dam. They are: the lack of a main overflow spillway, water flowing out of the headwall above the outlet conduit, the potential for blockage of the small outlet conduit, and siltation of the existing outlet approach channel.

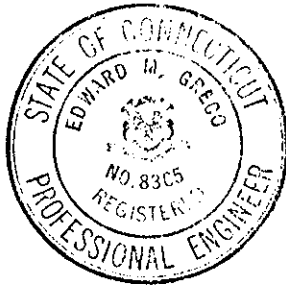
Hydraulic analyses indicate that the existing outlet can discharge a flow of 26 cubic feet per second (cfs) at Elevation (El) 522.8, which is the lowest point on the dam crest. Based on size and hazard classification in accordance with Corps guidelines, the test flood falls between the 100-year storm and one-half the probable maximum flood (PMF). An inflow test flood of 450 cfs (one-half PMF) will overtop the main dam by about 0.4 feet, indicating that the outlet facilities are inadequate. In the event of overtopping, localized erosion could occur in the control portion of the dam and could result in partial failure of the dam.

It is recommended that the Owner employ a qualified consultant to conduct a more detailed hydrologic and hydraulic investigation.

The Owner should construct an overflow spillway for the dam, repair the headwall above the outlet conduit, remove sand and silt in the existing outlet approach channel, and conduct a program of inspection and maintenance on a regular basis and during periods of high runoff. The inspections should include examination of the outlet conduit to be sure it is free of debris and/or soil. Also pieces of fallen stone from the downstream masonry wall should be replaced.

The above recommendations should be implemented within a period of 1 to 4 years after receipt of the Phase I Inspection Report. An alternative to these

recommendations would be to drain the pond and breach or remove the dam.



A handwritten signature in cursive script, reading "Edward M. Greco".

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A handwritten signature in cursive script, reading "Stephen L. Bishop".

Stephen L. Bishop, P.E.
Vice President
Metcalf & Eddy, Inc.

Massachusetts Registration
No. 19703



This Phase I Inspection Report on Peter Pond Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

CHARLES G. TIERSCH, Chairman
Chief, Foundation and Materials
Branch
Engineering Division

FRED J. RAVENS, Jr., Member
Chief, Design Branch
Engineering Division

SAUL C. COOPER, Member
Chief, Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in Recommended Guidelines for Safety Inspection of Dams, for a Phase I Investigation. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general conditions and the downstream damage potential.

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**OVERVIEW
PETER POND
DUDLEY, MASSACHUSETTS**



VIEW OF UPSTREAM FACE OF DAM

NATIONAL DAM INSPECTION
PROGRAM

PHASE I INSPECTION REPORT

PETER POND

SECTION 1

PROJECT INFORMATION

1.1 General

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Metcalf & Eddy, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Massachusetts. Authorization and notice to proceed was issued to Metcalf & Eddy, Inc. under a letter of May 3, 1978, from Ralph T. Garver, Colonel, Corps of Engineers. Contract No. DACW 33-78-C-0306 has been assigned by the Corps of Engineers for this work.

b. Purpose:

- (1) Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.
- (2) Encourage and assist the States to initiate quickly effective dam safety programs for non-Federal dams.
- (3) To update, verify and complete the National Inventory of Dams.

1.2 Description of Project

- a. Location. The dam is located in the Town of Dudley, Worcester County, Massachusetts, on a tributary of the French River.
- b. Description of Dam and Appurtenances. Peter Pond Dam is an earthfill dam with a vertical masonry wall on the downstream face. The embankment is 225 feet long and 10 feet high. The stone masonry wall is 88 feet long, 2 to 8 feet high, and about 3.5 feet thick. Discharge from the pond flows over flashboards near the center of the dam and through a stone box conduit with the outlet at the downstream stone masonry wall (see Figure B-1 in Appendix B).

The dam crest which is 7 to 15 feet wide varies in elevation from 522.8 to 524.2. The crest area is covered with grass. The upstream dam slope varies from 3:1 to 6:1 (horizontal : vertical). The western half of the upstream slope is grass-covered, while the eastern half is a sandy beach.

The elevation along the top of the downstream stone masonry wall varies from 522.6 to 523.3. The downstream slope from the dam crest to the top of the wall is about 7:1. To the east and west of the wall, the remaining portion of the downstream dam is a grass embankment sloping at about 4:1.

The centerline of the outlet conduit is located 30 feet east of the west end of the downstream masonry wall. The approach channel is 8 feet wide at current pond level and 3.6 feet wide at the crest. The concrete wing walls are about 3.5 feet thick, and the bottom is natural sand and silt. The length of the approach channel perpendicular to the dam axis is 12.3 feet.

The weir-controlled outlet structure is comprised of wooden cribbing with wooden flashboards mounted on top and held in place with steel slide rails. The boards are 3.6 feet long and a total of 2.4 feet high. The elevation of the top of the flashboards is 519.1.

The opening of the stone box conduit is about 6 feet downstream of the flashboards. The concrete sidewalls of the weir extend to the sides of the outlet opening. A stone masonry headwall is above the outlet to the top of the sidewalls. The conduit is 1.0 feet high by 1.9 feet wide with an invert elevation of 514.9. The length of the conduit is about 11 feet from its opening below the spillway to its outlet at the downstream headwall. Flow from the conduit discharges into a stream channel 2 to 4 feet wide with steep side slopes. The edges of the channel are lined with placed stone. The outlet channel discharges into a 24-inch diameter corrugated metal culvert 130 feet downstream of the dam. The water flows through a second culvert 900 feet downstream of the dam and eventually flows into Merino Pond for a total distance of about 2,500 feet downstream of the dam.

- c. Size Classification. Peter Pond Dam is classified in the "small" category since it has a maximum height of 10 feet and a maximum storage capacity of 350 acre-feet.
- d. Hazard Classification. Immediately downstream of the dam there are three roads, a few residences, and Merino Pond. In the event of dam failure, few lives could be lost, although some property damage might occur. The flood wave resulting from failure of the dam would be dissipated by Merino Pond, and therefore have little effect in the Town of Webster, located 1.1 miles downstream. The dam was listed by the Corps of Engineers as being in the "high" hazard category in the February, 1974, Inventory of Dams in the United States. This classification was reduced as a result of the inspection of the downstream area. Accordingly, the dam is reclassified in the "significant" category.
- e. Ownership. A section of the dam which includes the outlet is presently owned by the Stevens Linen Co. Mr. Robert Javery (617-943-0600) granted permission to enter the property and to inspect the dam.

- f. Operator. The Owner does not operate the dam and stated that the water level is fairly constant. Local residents who use the pond for recreation may adjust the unlocked flashboards.
- g. Purpose of the Dam. The dam was originally built to store water for power to the Stevens Linen Co. Presently, the pond is intended as emergency storage for fire protection or for the textile factory. However, the pond has not been used for these purposes for at least 10 years.

The pond is used mostly for recreational activities such as swimming and boating. The eastern half of the upstream face is a sand beach, and a picnic area is downstream.

- h. Design and Construction History. The dam was build some time prior to 1925, probably about 1900 when other dams were built for Stevens Linen Co. There are no plans, specifications, or computations available from the Owner or from County or State offices concerning design or construction of the dam.

Review of old inspection reports at the Worcester County Engineer's office indicate that the dam had been in good condition from about 1925 to 1963. There was also a gate mechanism in the outlet area at least until 1969. Around 1963, the dam had deteriorated to a poor condition - the embankment needed fill and the gate was leaking. Reports indicated that the outlet structure was reconstructed in 1968, although the embankment and gate required further repair. No other information is available after that date.

- i. Normal Operating Procedures. There are no known operating procedures at the dam. The only apparent outlet control is the removable flashboards. The Owner stated that he visits the dam a few times each year.

1.3 Pertinent Data

- a. Drainage Area. The approximately 250-acre (0.39-square mile) drainage area above the dam consists of sparsely developed, wooded and gently rolling land.

- b. Discharge at Dam Site. Normal discharge from the pond above El 519 is over the flashboards. The water flows into a stone box conduit beneath the dam embankment. The conduit is 1.0 feet high by 1.9 feet wide with an invert elevation of 514.9. Flow continues downstream in an earth channel which is 2 to 4 feet wide at the bottom with side slopes of 3:1. The water then passes through a 24-inch diameter corrugated metal culvert beneath a local road. The discharge continues in a natural stream channel for a distance of about 2,370 feet from the culvert and then flows into Merino Pond. This stream flows beneath two roadways: Charleton Road, at about 550 feet from the dam, and Sawmill Road, at about 900 feet from the dam.

The outlet conduit can discharge an estimated 26 cfs at El 522.8 which is the dam crest. An inflow test flood of 449 cfs (one-half of the probable maximum flood) will locally overtop the dam at the spillway by less than 0.4 foot. The maximum flood at the site is unknown.

- c. Elevation (feet above MSL (Mean Sea Level)). A benchmark elevation of 519.0 on the top of the wing wall at the upstream water surface was estimated from a U.S.G.S. topographic map.

- (1) Top dam: varies from 522.8 to 524.2
- (2) Test flood pool: 523.2
- (3) Design surcharge (original design): Unknown
- (4) Full flood control pool: Not applicable (N/A)
- (5) Recreation pool: 519
- (6) Outlet structure (ungated):
519.1 top of flashboards
516.7 bottom of flashboards
- (7) Upstream portal invert diversion tunnel: N/A

- (7) Stream bed at centerline of dam:
514.5 downstream of stone conduit
- (8) Tailwater: 515.5 downstream of flashboards
515.5 downstream of stone conduit

d. Reservoir

- (1) Length of maximum pool: 2,000 feet
- (2) Length of recreation pool: 1,800 feet
- (3) Length of flood control pool: N/A

e. Storage (acre-feet)

- (1) Test flood surcharge: 165 at EL 523.2
- (2) Top of dam: 350
- (3) Flood control pool: N/A
- (4) Recreation pool: 200 (approximate)
- (5) Spillway crest: 200

f. Reservoir Surface (acres) (It is assumed that an increase in elevation from 519 to 522.8 will not significantly increase the surface area of the pond.)

- (1) Top dam: 40
- (2) Test flood pool: 40
- (3) Flood-control pool: N/A
- (4) Recreation pool: 40
- (5) Spillway crest: 40

g. Dam

- (1) Type: Earthfill dam with dry-stone masonry downstream wall
- (2) Length: 225 feet

- (3) Height: 10 feet
 - (4) Top width: 7 to 15 feet
 - (5) Side slopes: 3:1 to 6:1 upstream
4:1 to vertical wall
downstream
 - (6) Zoning: Unknown
 - (7) Impervious core: Unknown
 - (8) Cutoff: Unknown
 - (9) Grout curtain: Unknown
- i. Spillway. (There is no spillway at this site. Discharge is through a weir-controlled outlet structure as described below.)
- (1) Type: Drop inlet (flashboards on wood cribbing)
 - (2) Crest length: 3.6 feet
 - (3) Crest elevation: 519.1 top of flashboards
516.7 bottom of flashboards
 - (4) Gates: None
 - (5) Upstream channel: Concrete wing walls 5 feet high at flashboards, taper from 8.2 feet wide opening at edge of water to 3.6 feet wide at flashboards, channel invert elevation 517.2, length 12.3 feet
 - (6) Downstream channel: Concrete sidewalls 8 feet high, taper from 3.6 feet wide at flashboards to 2 feet wide at conduit opening, invert elevation 514.9, length 6.3 feet.
- j. Regulating Outlets. The only apparent outlet is an ungated, stone box conduit beneath the dam downstream of the spillway. The conduit is 11.0 feet long, 1.9 feet wide, and 1.0 feet high. The invert elevation is 514.9. Pond elevations may be regulated by adjusting the flashboards.

SECTION 2
ENGINEERING DATA

- 2.1 General. There are no plans, specifications, or computations available from the Owner, State, or County offices relative to the design and construction of the dam.

The only data used for this evaluation were visual observations during inspection, review of previous inspection reports, and conversations with the Owner and personnel from Town, State and County agencies.

We acknowledge the assistance and cooperation of personnel of the Massachusetts Department of Public Works: Messrs. Willis Regan and Raymond Rochford, and of the Massachusetts Department of Environmental Quality Engineering, Division of Waterways: Messrs. John J. Hannon and Joseph Iagallo.

Also, we acknowledge the cooperation and assistance of personnel from the Worcester County Engineer's Office: Messrs. John O'Toole, Joseph Brazauskas, and Mr. Wallace Lindquist - recently retired from county service.

Mr. Robert Javery of the Stevens Linen Company, granted permission to inspect the dam and provided some background information.

- 2.2 Construction Records. There are no detailed construction records available.
- 2.3 Operation Records. No operation records are available, and there is no daily record kept of pool elevation or rainfall at the dam site.
- 2.4 Evaluation
- a. Availability. Due to the age of this dam, there is limited engineering data available.
 - b. Adequacy. The lack of in-depth engineering data did not allow for a definitive review. Therefore the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on visual inspection, past performance history and sound engineering judgment.

- c. Validity. The limited engineering data available is valid.

SECTION 3
VISUAL INSPECTION

3.1 Findings

- a. General. The Phase I inspection of the dam at Peter Pond was conducted on June 26, 1978. A copy of the inspection checklist is included in Appendix A. Periodic inspections of this dam have been made by others since 1925, and a listing of these inspections is in Appendix B. In addition, earlier inspection reports were reviewed at the Worcester County Engineer's Office.
- b. Dam. The dam is an earthfill dam with a downstream masonry wall. An outlet structure is located approximately midway along the embankment. At the time of inspection, the western downstream and upstream slopes were grass. The eastern upstream slope was sandy and being used as a beach by local residents. The beach area showed evidence of minor erosion. The western downstream slope was riprapped, although the riprap was mostly covered with sand.

The downstream dry-masonry stone wall appeared in sound condition. Several large stones were missing near the eastern end.
- c. Appurtenant Structures. The outlet appears to be in satisfactory condition although siltation of the approach channel was noted. Flashboards had been added above a timber crib wall. Flow over the flashboards is immediately discharged through a 1.0 foot high by 1.9 feet wide outlet conduit and into a natural downstream channel.
- d. Reservoir Area. There are a few residences in the vicinity of Peter Pond Dam. The drainage area is primarily woodland and swamp.
- e. Downstream Channel. The channel is kept reasonably free of vegetation and debris. The channel side slopes are covered with brush and small trees.

Approximately 130 feet downstream, discharge flows under the roadway through a 24-inch diameter corrugated metal pipe culvert.

- 3.2 Evaluation. The above findings indicate that the dam has several minor signs of distress that should be corrected. Recommendations on remedial measures are stated in Section 7.

SECTION 4

OPERATING PROCEDURES

- 4.1 Procedures. There are no operating procedures at this dam.
- 4.2 Maintenance of the Dam. The Owner stated that the dam is inspected several times a year. Although no recent maintenance was reported by the Owner, the dam is in generally good condition. Local residents and abutting property owners apparently maintain the area, as it was relatively free of debris and brush.
- 4.3 Maintenance of Operating Facilities. No recent maintenance of the outlet facilities was reported by the Owner. We understand that the flashboards were installed "a few years ago" by local residents using lumber supplied by the Owner.
- 4.4 Description of any Warning System in Effect. There are no warning systems in effect at this dam.
- 4.5 Evaluation. There are no operating, maintenance, or warning systems in effect at Peter Pond Dam. This is undesirable since the dam is in the "significant" category. A program of operation and maintenance should be implemented as recommended in Section 7.

SECTION 5

HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

- a. Design Data. The Probably Maximum Flood (PMF) rate was determined to be 2,300 cfs per square mile. This calculation is based on the average drainage area slope of 5.3 percent, the pond-plus-swamp area to drainage area ratio of 28.2 percent, and the U.S. Army Corps of Engineers' guide curves for Maximum Probable Flood Peak Flow Rates (dated December 1977). Applying one-half the PMF to the 0.39 square miles of drainage area results in a calculated peak flood flow of 450 cfs as the inflow test flood. By adjusting the inflow test flood for surcharge storage, the maximum discharge rate was established as 30 cfs (77 cfs per square mile), with a water surface at El 523.2.

Since the lowest point on the dam crest is 522.8, nearly the entire flow (26 cfs) will be over the flashboards and through the outlet conduit, while local overtopping of the crest would be about 4 cfs. Flow at critical depth would be at 0.23-foot depth with a velocity of 2.8 feet per second.

Hydraulic analyses indicate that the existing outlet conduit can discharge a flow of 26 cfs at water surface El 522.8.

- b. Experience Data. Hydraulic records are not available for this dam. Also, there is no information as to whether this dam has ever been overtopped.
- c. Visual Observations. There is no overflow spillway for the dam. The outlet structure is located near the midpoint of the dam. The approach channel to the outlet is bounded by two concrete wing walls. The weir consists of wooden flashboards mounted on top of wooden cribbing. Flow over the flashboards is discharged through the small stone box conduit beneath the dam.

Due to the small size of the outlet conduit, blockage of the opening could easily occur. No other outlet for discharge at this site was observed.

- d. Overtopping Considerations. Assuming that the small outlet is not blocked, only minor overtopping of the dam is expected under the inflow test flood of 450 cfs. Further, the 100-year storm would be discharged with a freeboard of nearly 3 feet.

No records are available as to whether this dam was overtopped. In the event of overtopping, localized erosion of the dam could occur. This would occur in the central portion of the dam and could result in partial failure of the dam.

SECTION 6

STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

- a. Visual Observations. The evaluation of Peter Pond Dam is based on the visual inspection on June 26, 1978. There appear to be no major areas of concern that would eventually reduce the existing stability of the dam.

Based on field observation, Peter Pond Dam does not appear to be unstable. Static stability conditions are probably satisfactory although conventional factors of safety which are currently required may not exist.

- b. Design and Construction Data. Discussions with the Owner, Town, County and State personnel indicate that there are no plans, specifications, or computations relative to the design, construction, or repairs of this dam. Information on the type, shear strength, and permeability of the soil and/or rock materials of the dam embankment is not available.
- c. Operating Records. There is no evidence of instrumentation of any type in Peter Pond Dam, and there is nothing to indicate that any instrumentation was ever installed in this dam. The performance of this dam under prior loading can only be inferred by previous records and physical evidence at the site.
- d. Post-Construction Changes. There are no as-built drawings for Peter Pond Dam. Review of inspection reports and discussion with County personnel and with the Owner indicate that some changes and/or repairs have been made to the dam. We understand that an old gate structure had been removed in the past. Additionally, the embankments were regraded and brush and trees were removed.
- e. Seismic Stability. The dam is located in Seismic Zone No. 2 and in accordance with Phase I "Recommended Guidelines" does not warrant seismic analyses.

SECTION 7

ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

- a. Conditions. Due to its age, Peter Pond Dam was neither designed nor constructed to the current approved state-of-the-art methods. Based upon the visual inspection at the site, the dam is considered to be in good to fair condition. However, there are minor areas of concern which should be corrected to assure continued performance of the dam: the lack of a main overflow spillway, water flowing from the spillway headwall above the outlet conduit, the potential for blockage of the small inlet to the outlet conduit, and siltation of the spillway approach channel.

Hydraulic analyses indicate that the spillway can discharge a flow of 26 cfs at El 522.8 which is the lowest point on the dam crest. An inflow test flood of 450 cfs (half of the PMF flood) will overtop a portion of the main dam by less than 0.4 foot. Overtopping would probably cause localized erosion of the dam and could result in a partial failure of the dam. Blockage of the outlet conduit could cause a greater potential for overtopping and could result in a more severe failure of the dam.

- b. Adequacy of Information. The lack of in-depth engineering data did not allow for a definitive review. Therefore the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on visual inspection, past performance history and sound engineering judgment.
- c. Urgency. The remedial measures outlined below should be implemented within 1 to 4 years of receipt of the Phase I Inspection Report.
- d. Need for Additional Information. Additional investigations to further assess the adequacy of the dam are not considered warranted at this time.

7.2 Recommendations. In view of the concerns for the continued performance of this dam, it is recommended that the Owner employ a qualified consultant to:

- a. Conduct a more detailed hydrologic and hydraulic investigation for the entire drainage area. The purpose of the investigation is to design an overflow spillway.

The recommendations for repairs and maintenance procedures are stated below under Section 7.3 Remedial Measures.

7.3 Remedial Measures

- a. Alternatives. An alternative to conducting remedial measures would be to drain the reservoir and breach the dam. It is recommended that the Owner accomplish the following:
 - (1) construct an overflow spillway which could handle all of the required outflow without overtopping the dam,
 - (2) repair the headwall above the outlet conduit where water flows out during the spring,
 - (3) implement a program of inspection and maintenance of the dam that would include an examination of the outlet conduit to insure that it is free of debris and/or soil. This program should be conducted at least once a month and at periods of heavy rainfall and/or runoff.
 - (4) Prior to construction of an overflow spillway, around the clock surveillance should be provided by the Owner during periods of unusually heavy precipitation. The Owner should develop a formal warning system with local officials for alerting downstream residents in case of emergency.

APPENDIX A
PERIODIC INSPECTION CHECKLIST

PERIODIC INSPECTION

PARTY ORGANIZATION

PROJECT Peter Pond Dam

DATE 6/26/78

TIME 2:05 E.D.S.T.

WEATHER Mild Overcast, Warm

W.S. ELEV. 518.6 * U.S. 515.5 D.N.S.

* assumed benchmark El 519.0
at upstream edge, top of concrete
wing wall.

PARTY:

- | | |
|-------------------------|----------------------|
| 1. <u>Ed Greco</u> | 6. <u>David Cole</u> |
| 2. <u>Lyle Branagan</u> | 7. _____ |
| 3. <u>Carol Sweet</u> | 8. _____ |
| 4. <u>Sue Pierce</u> | 9. _____ |
| 5. <u>Richard Weber</u> | 10. _____ |

PROJECT FEATURE	INSPECTED BY	REMARKS
1. <u>dam embankment</u>	<u>Ed Greco</u>	
2. <u>spillway / outlet conduit</u>	<u>Lyle Branagan</u>	
3. _____		
4. _____		
5. _____		
6. _____		
7. _____		
8. _____		
9. _____		
10. _____		

PERIODIC INSPECTION CHECK LIST

PROJECT Peter Pond Project Dam DATE 6/26/78
 PROJECT FEATURE dam embankment NAME Ed Greco
 DISCIPLINE geotechnical NAME Richard Weber

AREA EVALUATED	CONDITIONS
<u>DAM EMBANKMENT</u>	
Crest Elevation	<i>varies from 522.8 to 524.2</i>
Current Pool Elevation	<i>518.6</i>
Maximum Impoundment to Date	<i>unknown</i>
Surface Cracks	<i>None Visible</i>
Pavement Condition	<i>None</i>
Movement or Settlement of Crest	<i>Low Pt above Outlet</i>
Lateral Movement	<i>None Apparent</i>
Vertical Alignment	<i>Irregular Crest</i>
Horizontal Alignment	<i>Regular</i>
Condition at Abutment and at Concrete Structures	<i>Outlet Appr. Channel Good Condition</i>
Indications of Movement of Structural Items on Slopes	<i>N/A</i>
Trespassing on Slopes	<i>Docks, Trees, Beach</i>
Sloughing or Erosion of Slopes or Abutments	<i>Minor Beach Area Erosion</i>
Rock Slope Protection - Riprap Failures	<i>Riprap (Large Stone) Buried under beach area sand</i>
Unusual Movement or Cracking at or near Toes	<i>None</i>
Unusual Embankment or Downstream Seepage	<i>None</i>
Piping or Boils	<i>None Noted</i>
Foundation Drainage Features	<i>N/A</i>
Toe Drains	<i>None Known (Rock Wall - open masonry)</i>
Instrumentation System	<i>None</i>

PERIODIC INSPECTION CHECK LIST

PROJECT Peter Pond Dam DATE 6/26/78
 PROJECT FEATURE spillway/outlet approach NAME Lyle Brannagan
 DISCIPLINE geotechnical NAME Ed Greco

AREA EVALUATED	CONDITION
<u>OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE</u>	
a. Approach Channel	<u>Open</u>
Slope Conditions	<u>Conc. Side Walk</u>
Bottom Conditions	<u>Sand Filled to 10" bel. flash bds.</u>
Rock Slides or Falls	<u>N/A</u>
Log Boom	<u>N/A</u>
Debris	<u>None</u>
Condition of Concrete Lining	<u>Good</u>
Drains or Weep Holes	<u>N/A</u>
b. Intake Structure	
Condition of Concrete	<u>Good</u>
Stop Logs and Slots	<u>Good (Flash Boards)</u>

PERIODIC INSPECTION CHECK LIST

PROJECT Peter Pond Dam
 PROJECT FEATURE outlet conduit
 DISCIPLINE geotechnical

DATE 6/26/78
 NAME Lyle Bragan
 NAME Ed Greco

AREA EVALUATED	CONDITION
OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL	
General Condition of Concrete	<u>None</u>
Rust or Staining	<u>N/A</u>
Spalling	<u>N/A</u>
Erosion or Cavitation	<u>N/A</u>
Visible Reinforcing	<u>N/A</u>
Any Seepage or Efflorescence	<u>N/A</u>
Condition at Joints	<u>N/A</u>
Drain Holes	<u>N/A</u>
Channel	<u>Nat. Stream - minor stone walls (12"± high) along sides</u>
Loose Rock or Trees Overhanging Channel	<u>Several Large Nearby Trees</u>
Condition of Discharge Channel	<u>Natural Stream</u>

APPENDIX B

PLAN OF DAM AND PREVIOUS INSPECTION REPORTS

	<u>page</u>
Figure B-1. Plan of Dam, and Sections	B-1
Previous Inspections (Partial Listing)	B-2
Inspection Report by Massachusetts Department of Public Works, January, 1972	B-3

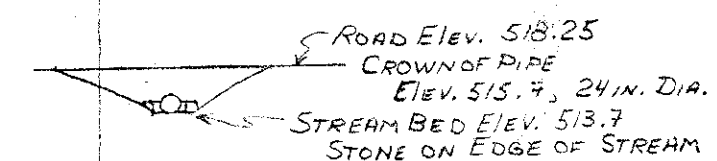
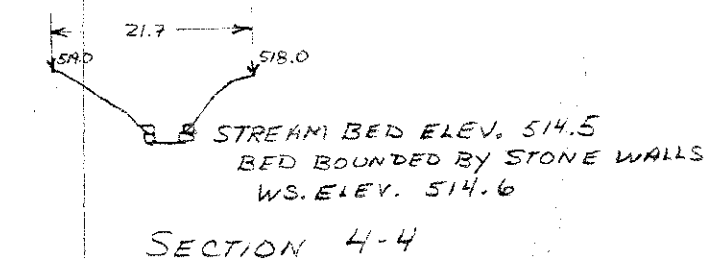
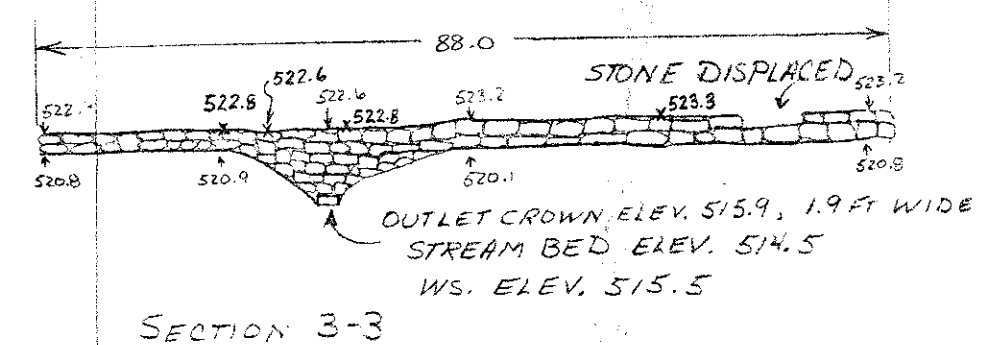
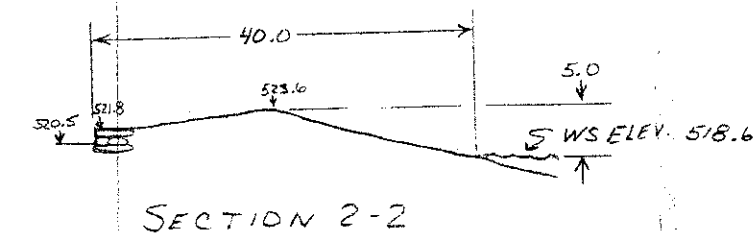
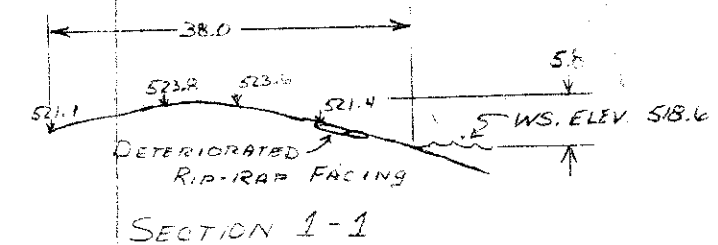
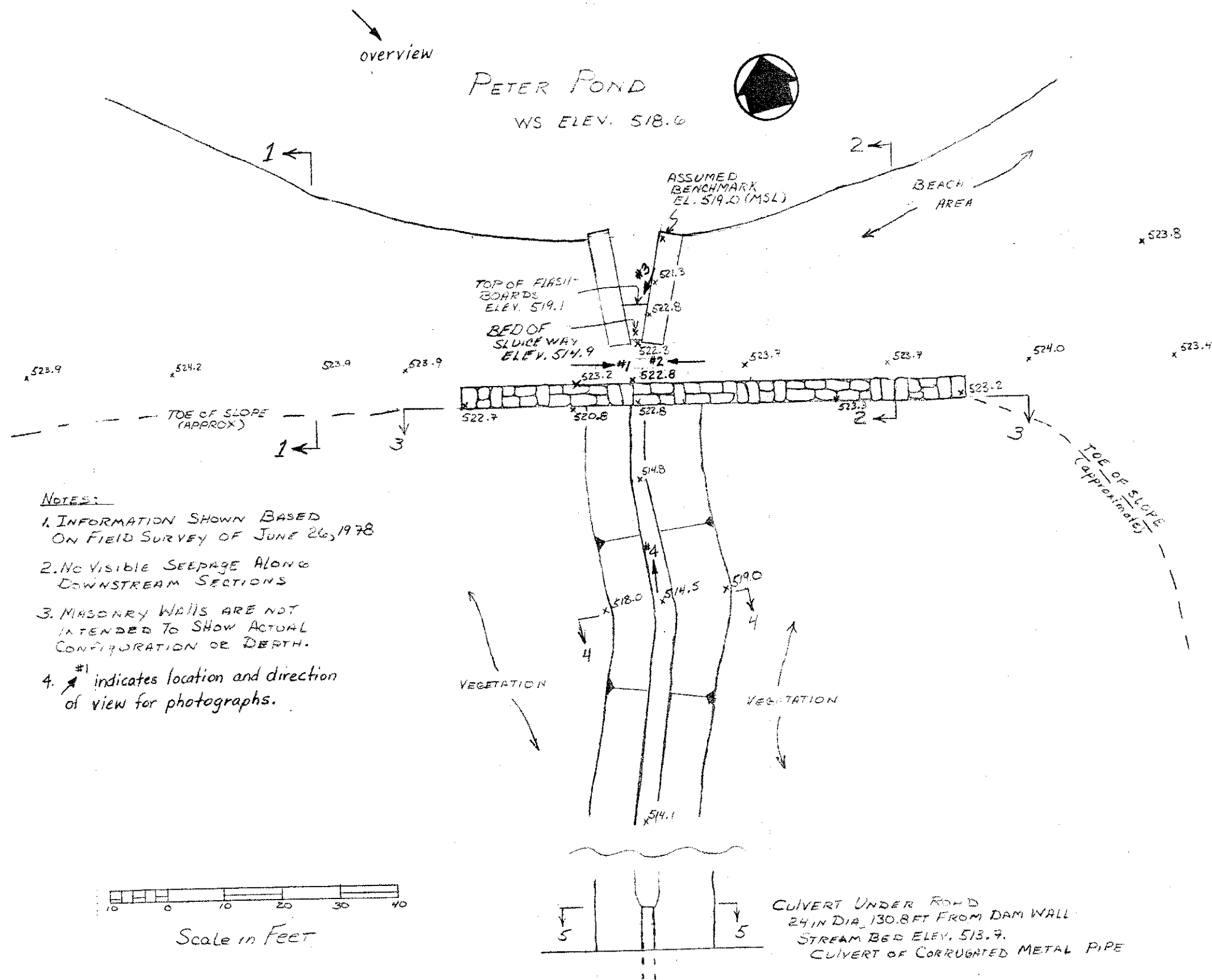


FIGURE B-1 PLAN OF DAM AND SECTIONS

TOWN OR CITY	Dudley	(OLD STORAGE POND) (M) PLAN NO.	DAM NO. 1-1-09
LOCATION	Peter Pond Dam - 3/4 mile N.W. Webster Center.	DECREE NO.	C.C. DOCKET NO. 80
DESCRIPTION OF DAM		DESCRIPTION OF RESERVOIR & WATERSHED	
Type	Earth - Dry Wall. - El. 100'	Name of Main Stream	Peter Pond.
Length	300'±	" " any other Streams	
Height	8'±	Length of Watershed	
Thickness top	abt = 12' crest = 12' cmb = 12'	Width " "	
" bottom	spill = 24' " = 24'	Is Watershed Cultivated	
Downstream Slope	Vertical	Percent in Forests	Letter 9/1/55
Upstream "	1 1/2:1 Riprap.	Steepness of Slope	
Length of Spillway	None	Kind of Soil	Gravel.
Size of Gates	waste El. 92.0 2 1/2 X 1	No. of Acres in Watershed	0.41 S. M.
Location of Gates	& Dam.	" " " Reservoir	44. A.
Flashboards used	None	Length of Reservoir	
Width Flashboards or Gates	—	Width " "	
Dam designed by		Max Flow Cu. Ft. per Sec.	
" constructed by		Head or Flashboards-Low Water	
Year constructed		" " " High	1938 Flood - 4' below Abt
GENERAL REMARKS		GENERAL REMARKS	
Owned by Stevens Linen Associates, Inc.		Inspected: Dec. 30, 1941 - H. F. Hunt	
Inspected Jan. 7, 1925 - L. O. Marden		" : Dec. 10, 1942 - J. A. Herholz	
" 2-9-27 "		" Dec. 1, 1947 - L. O. M.	
" 4-2-30 - L. O. M. & Crawford		" Nov 29, 1951 - L. H. S.	
" July 27, 1932 "		(TOWN OF DUDLEY?)	
" Jan. 6, 1934 "			
" Jan. 13, 1937 - Mast. Mech. Healey			
Measured: Oct. 19, 1938 - E. S. Grover			
Inspected: Dec. 11, 1940 - W. O. L.			

2-Library Bureau 10-92260

PREVIOUS INSPECTIONS (PARTIAL LISTING)

COPY OF INSPECTION CARD ON FILE AT THE MASSACHUSETTS
DEPARTMENT OF PUBLIC WORKS, DISTRICT OFFICE, WORCESTER.

INSPECTION REPORT & DATA FOR DAMS

Owner: STEVENS LINEN ASSOCIATES, INC.
 His Address: MILL ST. DUDLEY
 Function of Dam: OLD STORAGE POND

Dam No. 14-09
 Town: DUDLEY
 Stream: BROOK
 Pond: PETER POND
 Date: 1/10/72
 By: _____

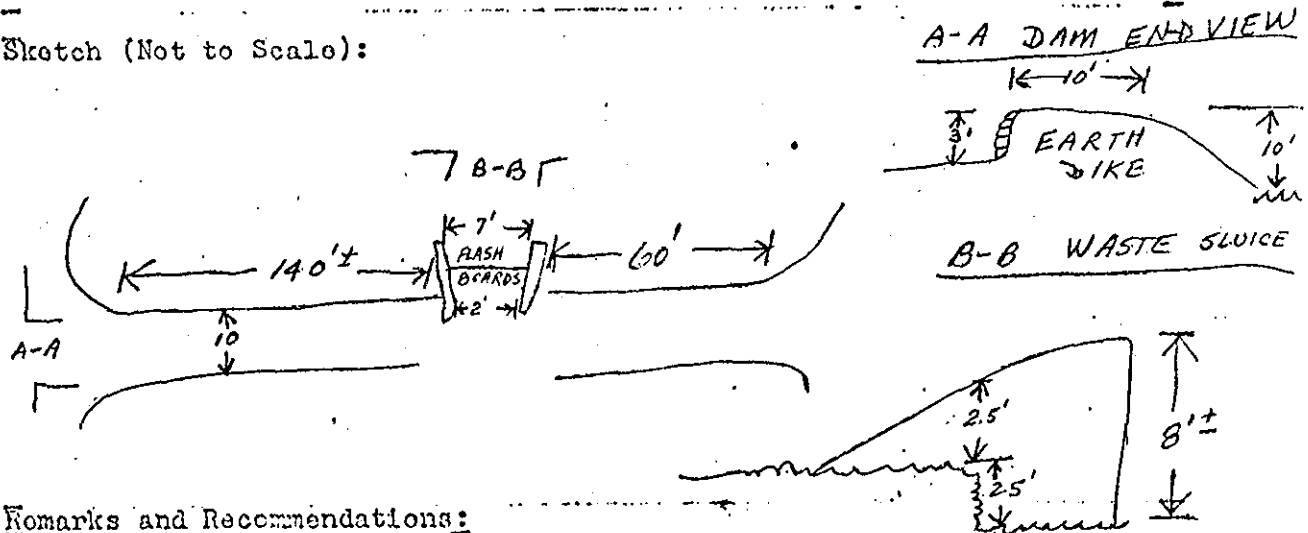
Location & Access: 100 YDS NW. ON CHARLTON RD
FROM JCT CHARLTON & SAWMILL RDS.
 USGS Quad. Webster Lat. 42°03'35" Long. 71°53'15"
 Drain. Ar.: 291 Sq. Mi.; Ponds: _____ ac.; Res. (dam): 4.1
 Character of D.A.: _____

CONDITION RATING
 Structural: GOOD
 Hydraulic: 2.5X1'
 General: GOOD
 PRIORITY: NONE

Estimated
 Discharge: _____
 Capacity: _____

General Description of Dam and Discharge Control: EARTH - DRY WALL
WASTE GATE 2 1/2 X 1' REMOVED. WATER CONTROLLED
BY FLASH BOARDS 2" X 12" X 2.5' HIGH.

Sketch (Not to Scale):



Remarks and Recommendations:

Date

1/10/72

By V.F.P.
RH

Comment

Dam No. 14-09

APPENDIX C
PHOTOGRAPHS



NO. 1 - VIEW EAST FROM SLUICEWAY



NO. 2 - VIEW WEST FROM SLUICEWAY



**NO. 3 - VIEW OF SLUICEWAY WITH WOODEN
FLASHBOARDS IN FOREGROUND**



**NO. 4 - VIEW OF DOWNSTREAM CHANNEL
LOOKING TOWARD DAM**

APPENDIX D

HYDROLOGIC AND HYDRAULIC
COMPUTATIONS

(I) Determine Peak Rates of Runoff

Est Slope Elev. 700 to Elev. 519 in 3400'

Ave. Slope = 5.3%

Est Ponds & Swamps

Pond - 0.07 mi²
 Swamps - 0.04 "
 Total 0.11 mi²

Drainage Area 0.39 mi²

∴ 28.2% Ponds & Swamps

From "M.P.F. - Peak Flow Rates" by C. of E & modified:

Unit Rate is halfway between "Rolling" & "Leesville"
 but is off of chart.

After Extrapolation: Unit Rate = $\frac{1}{2}(2000 + 2000) = 2300 \text{ cfs/mi}^2$

P.M.F. = $2300 \times 0.39 = 897 \text{ cfs}$

$\frac{1}{2}$ P.M.F. = 449 cfs = Inflow Test Flood

100 year Flood

Use 5hr. 100yr storm rain of 4.7 in. less 6 hours of
 min. infiltration @ 0.10 inches/hour (Aw Type B & C Soils)

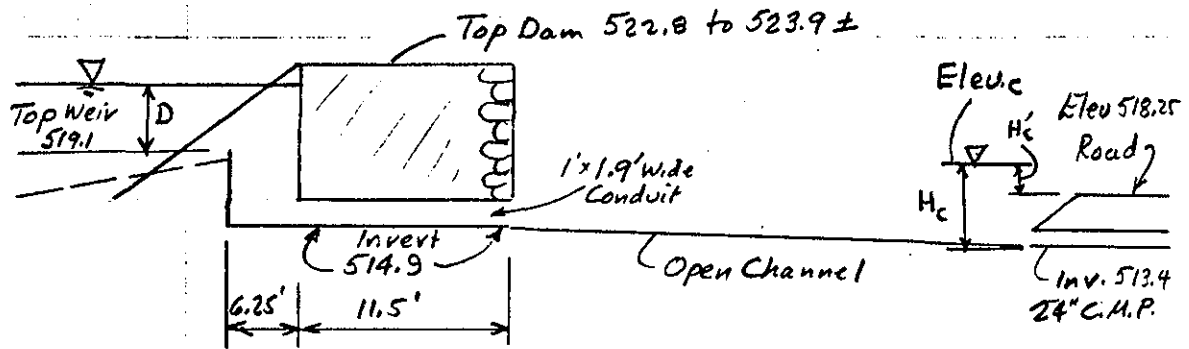
$$\text{Inflow } Q_{100} = 897 \left(\frac{4.7 - 1.1}{19 - 1.1} \right) = 180 \text{ c.f.s.}$$

Storage Functions

Inflow Test Flood: $Q_{out} = 449 \left(1 - \frac{S_F}{9.5} \right)$; $F_{TF} = 449 - 47.25$

100 yr. Flood: $Q_{out} = 180 \left(1 - \frac{S_F}{4.7} \right)$; $F_{100} = 180 - 38.35$

II Discharge & Storage vs Water Elevation



A- Disch. At Culvert (Ent. Control) [Ref. V.T.C. Open Ch. Fl. pg 498]

1- To top of Road: $H/d = \frac{518.25 - 513.4}{2} = 2.425$; $Q_c = 31$ cfs.

2- Above top of Road:

Flow Over Road - $q_c = 2.55(H'_c)^{3/2}$ } $Q' = 255(H'_c)^{3/2}$
 Length of Road @ Elev. 518.25 $\approx 100'$

Table of Q vs H_c vs Elev. c (Q_c taken from Ref. above)
 (for Culvert)

Elev. c	520.5	520.0	519.5	519	518.5	518	517	516
H_c	7.1	6.6	6.1	5.6	5.1	4.6	3.6	2.6
Q_c	38	36	35	32	30		25	18
H'_c	2.25	1.75	1.25	0.75	0.25	—	—	—
Q'	840	590	356	166	32	—	—	—
Q_{Tot}	898	626	391	198	62		25	18

B- Storage above Weir Crest (Elev. 519.1) & Storage Functions

S = Storage in inches on D.A. = $12 \left(\frac{107}{39} \right) D = 2.15 D$; D in feet.

Elev.	520	521	522	523	523.5
S	1.9	4.1	6.2	8.4	9.5
F_{TK}	359	255	156	52	0.4
F_{100}	107	23	-57		

II Disch. & Stor. vs Water Elev. (Cont.)

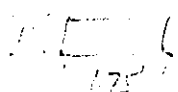
C - Disch. at Dam

1 - Weir Discharge - Weir 3' wide - Side Contr. Suppressed
 [Ref. Hydr. Tables - Williams & Hagen - use $p = 6$]

Pond Elev.	520	521	522	523	524
Q_w	9	27	51	82	118

2 - Conduit Discharge - Free Disch. - T.W. Elev. = 515.4

Losses - Entrance = $0.5 h_v$
 Exit = $1.0 h_v$ } = $1.5 \frac{Q^2}{A^2 g} = .0076 Q^2 = \Delta_m$



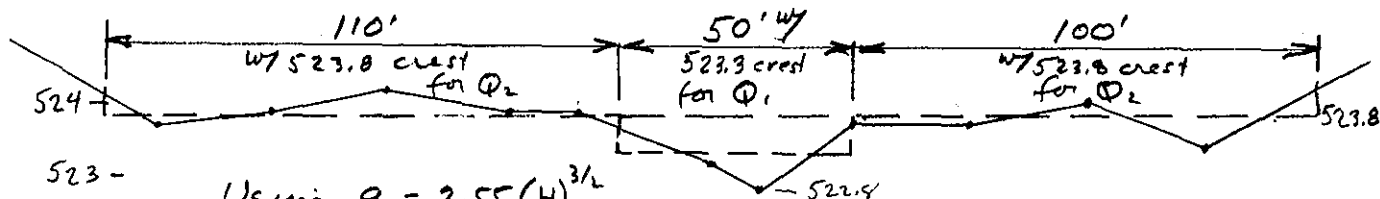
Friction: $Q = (1)(1.49) \left(\frac{1.49}{.02} \right) (4.66) \left(\frac{\Delta_f}{11.5} \right)^{1/2} = 19.45 \Delta_f^{1/2}$

$\Delta_f = .0026 Q^2$

\therefore Total Hd. Loss = $.0102 Q^2 = \Delta$ or $Q = 9.901 (\Delta)^{1/2}$
 Elev. above Ent. = 515.4 + Δ

Conduit Ent. Elev.	516.5	518	519	520	522	524	526
Δ (ft)	1.1	2.6	3.6	4.6	6.6	8.6	10.6
Q (cfs)	10	16	19	21	25	29	32

3 - Flow over Dam Crest -



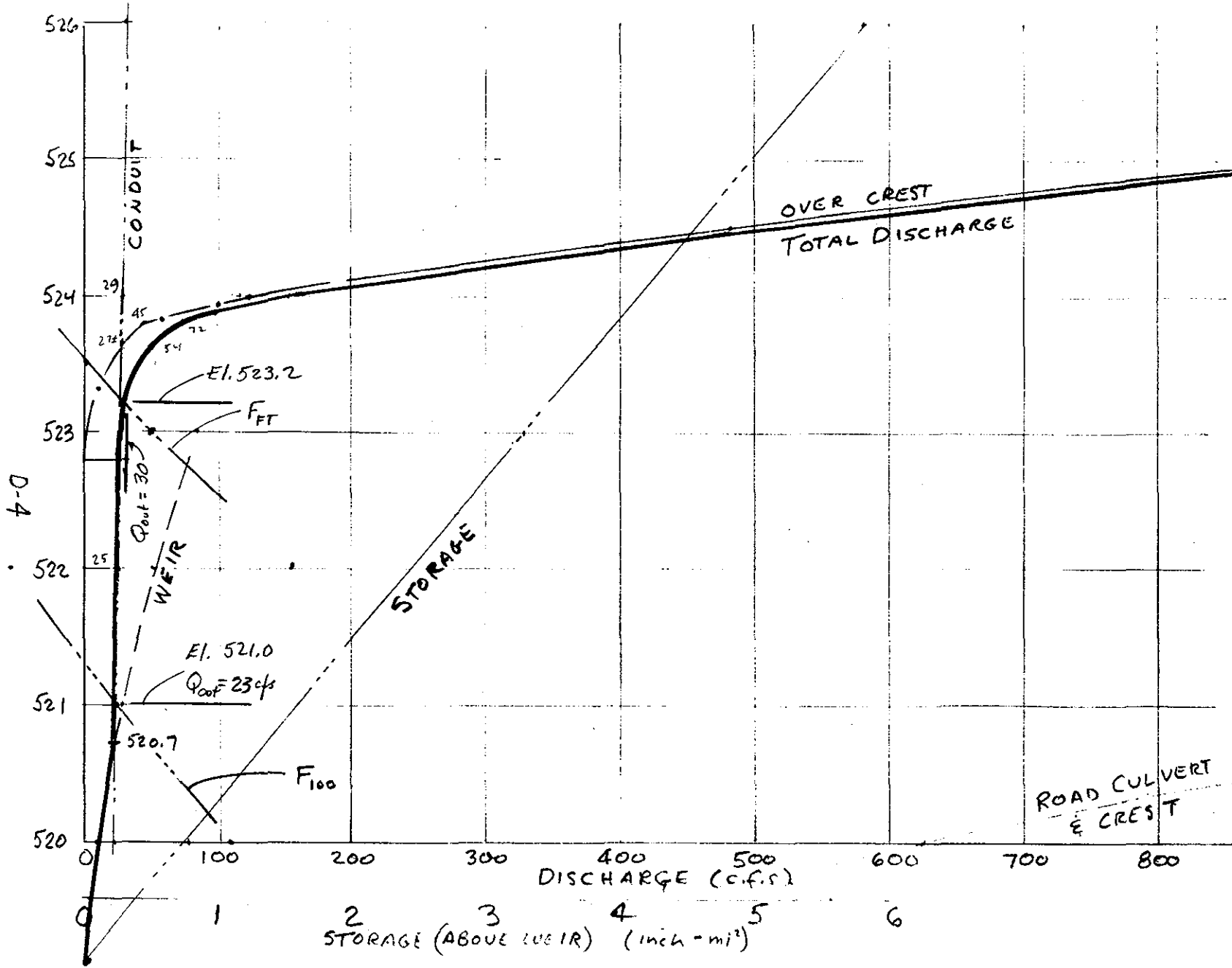
Using $q = 2.55 (H)^{3/2}$

Pond Elev. =	523.8	524	524.5	525	525.5
$Q_1 = (P.E. - 523.3)^{3/2} (127.5) =$	45	75	168	283	416
$Q_2 = (P.E. - 523.8)^{3/2} (535.5) =$	—	48	314	704	—
$Q_{Tot} =$	45	123	482	987	—



Discharge & Storage Functions vs Elevation

Project	NAT. REVIEW OF NON FEO. DAMS	Acct. No.	5864	Page	4
Subject	WORCESTER MASS. AREA	Compt. By	LEB	Date	7/7/78
Detail	PETER POND DAM	CK'd. By	SMC	Date	11/28/77



ROAD CULVERT
E CREST

IV Peak Discharge Rates
 (From Item III Plot)

Test Flood: $Q_{out} = 30 \text{ cfs @ Pond Elev. } 523.2$

100 yr Flood: $Q_{out} = 23 \text{ cfs @ Pond Elev } 521.0$

V Crest Flood Under Test Flood

$$\text{Max Depth} = 523.2 - 522.8 = 0.4'$$

$$q = 2.55 (0.4)^{1.5} = 0.65 \text{ cfs/ft}$$

$$\text{Critical Depth} = \left(\frac{q^2}{g} \right)^{1/3} = 0.23 \text{ ft.}$$

$$\text{Critical Vel.} = 2.8 \text{ f.p.s.}$$

VI Full Pond "Spillway" Outflow (El. 522.8)

From Item III: $Q_{FP} = 26 \text{ cfs. [Conduit Controls]}$

APPENDIX E
INVENTORY FORMS